

REMARKS/ARGUMENTS

The Office Action mailed April 28, 2006 has been carefully considered. Reconsideration in view of the following remarks is respectfully requested.

In the specification, the paragraphs [0037], [0040], and [0048] have been amended to correct minor editorial problems. No new matter has been added.

New claims 15 - 27 have been added. Support for new claims 15 – 27 is found in the specification, drawings, and claims as originally filed. Applicants submit, therefore, that the addition of new claims 15 – 27 does not add new matter.

The First 35 U.S.C. § 103 Rejection

Claims 1, 3-5 and 7-14 were rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Aspar et al. (hereinafter Aspar et al. '079)¹, among which claim 1 is an independent claim. This rejection is respectfully traversed. Claim 1, includes the following limitations.

Method for making a thin layer starting from a wafer comprising a front face divided into surface elements and with a given relief, and a back face, comprising steps consisting of:

- a) obtaining a support handle with a face acting as a bonding face;
- b) preparing the front face of the wafer, this preparation including incomplete planarisation of the front face of the wafer, to obtain a bonding energy E_0 with the bonding face of the support handle, between a first value corresponding to the minimum bonding energy compatible with the later thinning step, and a second value corresponding to the maximum bonding energy compatible with the subsequent desolidarisation operation, the bonding energy E_0 being such that $E_0 = \alpha \cdot E$, where E is the bonding energy that would be obtained if the front face of the wafer was completely planarised, α is the ratio between the incompletely planarised surface of the front face of the wafer and the surface of the front face of the wafer if it were completely planarised;

¹ U.S. Patent No. 6,204,079

- c) solidarising the front face of the wafer on the bonding face of the support handle, by direct bonding;
- d) thinning the wafer starting from its back face until the thin layer is obtained;
- e) transferring the surface elements from the thin layer onto a usage support, involving separation from the support handle.

(Claim 1) (Emphasis added)

Applicants respectfully submit that Aspar does not contain the limitations of incomplete planarization to obtain a bonding energy between a minimum bonding energy compatible with a later thinning step and a maximum bonding energy compatible with a later desolidarization operation, the bonding energy dependent upon the ration of the bonding energy of a completely planarized front face of the wafer and the bonding energy of a incompletely planarized front face of the wafer.

As cited by the Examiner, Aspar discloses the following.

Semiconductor chips 4 are designed to be transferred selectively. In order to do this, the initial substrate surface on which the chips are made will be prepared to enable hydrophilic bonding with a controlled bonding energy. This surface preparation, illustrated in FIG. 2, may include the deposit of a layer 8 in which semiconductor chips 4 are embedded. The layer 8 may be a layer of silicon oxide on which a planarization operation has been carried out if the topology of its free surface makes it necessary.

The bonding energy of a surface may be controlled by modifying the roughness of this surface. For example, for molecular bonding of two SiO₂ oxide wafers together (unpolished thermal oxide in each case), an average rms roughness of the order of 6 angstroms obtained by HF etching will give a bonding energy of the order of 250 mJ/m² after annealing at a temperature of 400.degree. C. for 30 minutes.

As shown in FIG. 3, a transfer support or handle 10 is bonded onto the free face of layer 8. If the face of layer 8 bonded to the face of transfer support 10 each have a roughness of the order of 6 angstroms rms, the bonding energy obtained is of the order of 250 mJ/m². Some alignment problems may be eliminated if the handle 10 is transparent (for example made of glass or pure silica).

(Aspar, col. 4, lines 45 – 67)

Prepared in this way, the transfer support 10 provided with elements 14 may be bonded onto the reception support 18 which has been cleaned such that the surface presented by it to elements 14 is hydrophilic. In the structure shown in FIG. 7, the bonding energy between elements 14 and the transfer support 10 is of the order of 250 mJ/m.². The bonding energy between element 14 with the hydrophilic surface treatment 16 and the reception support 18 exceeds 500 mJ/m.². The bonding energy between the other elements 14 with a hydrophobic surface treatment and the hydrophilic surface of the reception support 18 is of the order of 100 mJ/m.². Remember that bonding forces may be controlled by means of a heat treatment, for example at a temperature of 400.degree. C. and for 30 minutes.

(Aspar, col. 5, lines 44 – 57)

Aspar neither discloses or suggests the claimed limitations. This made clear by the fact that Aspar does not disclose incomplete planarization of the front face of the wafer. (See Aspar, col. 4, lines 51 – 53). However, even if Aspar can be construed to include incomplete planarization of the front face of the wafer. Aspar still lacks disclosure of the bonding energy range and ratio-dependence as claimed.

For these reasons applicants respectfully submit that claim 1 is not anticipated by Aspar. Given that claims 2 – 14 depend, directly or indirectly, from claim 1, applicants respectfully submit that claims 2 – 14 are, likewise, not anticipated by Aspar.

Applicants further submit that new claims 15 – 27 include allowable subject matter as identified by the Examiner.

In view of the foregoing, it is respectfully asserted that the claims are now in condition for allowance.

Conclusion

It is believed that this Amendment places the above-identified patent application into condition for allowance. Early favorable consideration of this Amendment is earnestly solicited.

If, in the opinion of the Examiner, an interview would expedite the prosecution of this application, the Examiner is invited to call the undersigned attorney at the number indicated below.

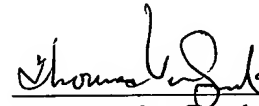
Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Please charge any additional required fee or credit any overpayment not otherwise paid or credited to our deposit account No. 50-1698.

Respectfully submitted,

THELEN REID & PRIEST, LLP

Dated: 9/21/06


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